

FEDDS HIGH SCHOOL
SPH4U: GRADE 12 UNIVERSITY PHYSICS
FINAL EXAM SEMESTER



FRIDAY MARCH 19, 2010
1:10 – 2:30 PM (1 HOUR 20 MINUTES)

NAME: _____

TEACHER: Ms Dhaliwal

INCLUDING THIS PAGE, THIS EXAM HAS 8 PAGES. PLEASE CHECK YOUR PAPERS. THE BREAKDOWN OF THE EXAM IS AS FOLLOWS:

SECTION	QUESTION TYPE	MARKS	SUGGESTED MAXIMUM TIMES PER SECTION (INCLUDES REVIEW)
A: Multiple Choice	5 questions Knowledge and Understanding	5	5 minutes
B: Long Answer	5 questions Inquiry STSE	50	75 minutes
Communication (COM) marked throughout Mathematical <ul style="list-style-type: none"> 1 mark per numerical question unit, final sd 		5	N/A
Total		60	80 minutes/ 1 hr 20 minutes
Formative (70)	Summative Projects (10)	Summative Exam (20)	Reported Final %

STUDENTS ARE PERMITTED

Calculator, Handwritten Approved Formula Sheet

All answers are to appear on the test paper in the spaces provided

Useful Constants:

Speed of light $c = 3.00 \times 10^8 \text{ ms}^{-1}$

Gravitational constant $G = 6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$

Coulomb's constant $k = 9.0 \times 10^9 \text{ Nm}^2\text{C}^{-2}$

Planck's constant $h = 6.63 \times 10^{-34} \text{ Js}$

Mass of electron $m_e = 9.1 \times 10^{-31} \text{ kg}$

Charge on electron $e = -1.6 \times 10^{-19} \text{ C}$

Radius of Earth $R_E = 6.38 \times 10^6 \text{ m}$

Mass of Earth $M_E = 5.98 \times 10^{24} \text{ kg}$

Rydberg's constant $R = 1.097 \times 10^7 \text{ m}^{-1}$

Atomic Mass Unit 1 A.M.U. = $1.67 \times 10^{-27} \text{ kg}$

Permeability of free space $\mu_0 = 4\pi \times 10^{-7} \text{ Tm/A}$

PART A: MULTIPLE CHOICE (5 marks)

*Identify the letter of the choice that best completes the statement or answers the question.
Write your answer in the space provided. (1 mark each)*

1. According to Newton's second law, the acceleration of an object is directly proportional to the net force applied to it. A student does an experiment to investigate this law. He applies a constant force F to a wooden block which is free to slide on a table, and measures the resulting acceleration a . He then applies twice the force and finds that the acceleration has tripled. Which one of the following statements is the correct conclusion to draw?
- a) Newton's second law is not valid under these conditions
 - b) There is a frictional force of $\frac{1}{2} F$ on the block.
 - c) There is a frictional force of $\frac{1}{4} F$ on the block.
 - d) There is a frictional force of $\frac{2}{3} F$ on the block.
 - e) There is a frictional force of $\frac{1}{3} F$ on the block.

ANS:

2. A mass 'm' moves with a velocity 'v' and collides in-elastically with a stationary mass 'm'. After collision, the 1st mass moves with velocity $v/\sqrt{3}$ in a direction perpendicular to the initial direction of motion. The speed of the second mass after collision will be:
- a) $\sqrt{3} v$
 - b) v
 - c) $v/\sqrt{3}$
 - d) $2v/\sqrt{3}$
 - e) $-v/\sqrt{3}$

ANS:

3. Sixty four equal charged drops are combined to form a big drop. If the potential on each drop is 10 volt, the potential on the big drop will be:
- a) 10 V
 - b) 40 V
 - c) 160 V
 - d) 640 V
 - e) 320 V

ANS:

4. In a Young's double slit experiment, instead of taking slits of equal widths, if one slit is made twice as wide as the other, then in the interference pattern
- a) the intensities of both the maxima and the minima increase
 - b) the intensity of the maxima increases and the minima has zero intensity
 - c) the intensity of the maxima decreases and that of minima increases
 - d) the intensity of maxima decreases and the minima has zero intensity
 - e) no change in the intensity of maxima and minima

ANS:

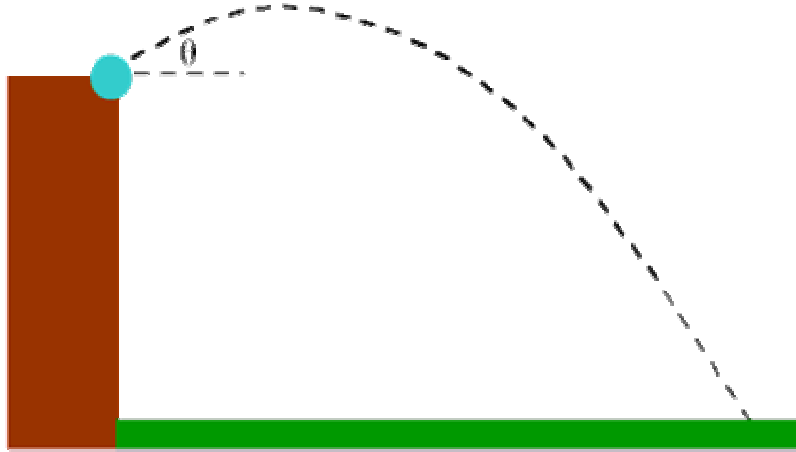
5. In order to increase the kinetic energy of the ejected photoelectrons, there should be an increase in
- a) Intensity of radiation
 - b) Wavelength of radiation
 - c) Frequency of radiation
 - d) Both the wavelength as well as intensity of radiation
 - e) Both the frequency as well as the intensity of radiation

ANS:

PART B: LONG ANSWERS (50 marks)

Answer all questions with full solutions in the space provided.

1. A stone is thrown from the top of a tower of height 50 m with a velocity of 30 m/s at an angle $\theta = 30^\circ$ above the horizontal.



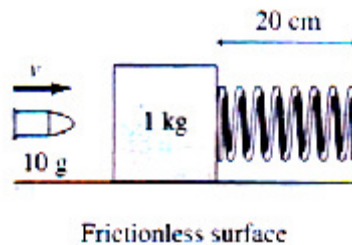
Find:

- a) The time during which the stone will be in air. (4)

- b) The distance from the tower base to where the stone will hit the ground (3)

c) The velocity with which the stone will hit the ground (5)

2. a) A 1-kg wooden block on a frictionless surface is attached to a 20-cm long spring that has a spring constant of 6 000N/m. A 10-g bullet is fired straight into the block where it sticks, causing the block to compress the spring a maximum of 5 cm. What is the speed of the bullet? (6)



b) Can a body have energy with having momentum? Explain. Can a body have momentum without having energy? Explain. (4)

3. An α -particle is describing a circle of radius 0.45 m in a magnetic field of 1.2 T. (The mass of α -particle is 6.8×10^{-27} kg and its charge is twice the charge of an electron, i.e., 3.2×10^{-19} C)
- a) Find the speed and kinetic energy (eV) of the α -particle (7)

b) What will be its frequency of rotation? (3)

4. A ripple tank is used to generate straight waves in region A that travel toward region B, which is separated from region A by a straight boundary. The frequency of the generator is 2.5 Hz, and the waves travel in region A with a speed of 15 cm/s. If the wave fronts in region A strike the boundary at 20° , and the wave fronts in region B leave the boundary at 50° ,

(a) Use Snell's law to find the relative index of refraction between the two regions (3)

(b) Find the wavelength in each region (6)

5. a) A car is moving at a rapid pace. It is approaching a garage with doors at either end. The proper length of the car is longer than the length of the garage. As the car travels through the garage, describe what the driver would observe. Describe what would be seen by a stationary observer inside the garage. (4)

b) NASA believes that the Compton effect may provide a solution for space vehicle propulsion. How could a “solar sail” be used to power a spaceship? (5)